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Complete reconstruction of the quantum state of a single-photon wave packet absorbed by a doppler-broadened transition

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Abstract

The reconstruction of the quantum state of a nonstationary single-photon wave packet absorbed by a Doppler-broadened transition was analyzed. The proposed technique was based on the property that frequency shifts due to the Doppler effect were opposite for counterpropagating directions. The quantum state storage solution and the recall of nonstationary single-photon wave packets in the medium was investigated. In the two-level photon echo scheme, the reconstructed field was absorbed as it propagated in the sample, and although the state was correctly mapped onto the atomic ensemble if the sample had a high optical density, it was only partly extracted.